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Structural Change, Success and Crisis in
Argentina: Mistaking Transitory for
Permanent Export Response

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ABSTRACT

The Argentine crisis of 2001 is examined, under the hypothesis that debt went beyond vulnerability limits because rising exports were perceived as providing permanent enhanced ability to borrow externally; in a prevalent optimistic mood a permanent negative shock in export prices in 1996 was mistakenly taken as purely transitory and further CA deficits deteriorated solvency. This paper provides analytical expression of this argument and explores simulated short run responses of the CA and cumulative debt dynamics. We parameterise a dynamic stochastic general equilibrium model resembling a SOE, simulate both permanent and transitory duration of external shocks, and a magnitude of debt overexpansion is computed. A policy implication is that the difficulty to distinguish trends from transitory disturbances indicate that vulnerable countries like Argentina need to be cautious in the use of external savings, particularly in processes of structural changes when forecasting is more difficult and risky.

JEL Classification: F12, F41, F47, F49

Keywords: Trade liberalisation, Crisis, Vulnerability, Export performance, DSGE models, NOEM models, Argentina, Latin America.

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1. INTRODUCTION

After the initial success of stabilisation and liberalisation policies in Argentina at the beginning of the 1990s, a solid growth process, which survived the repercussions of the Mexican Tequila in 1995, seemed to be under way. However, a gradual deterioration of key variables in the second half of the decade, and still unexplained policy failures accompanied by a bit of bad luck precipitated a crisis accompanied with riots, the resignation of President De la Rúa in December 2001, and the official default on external debt. Since then much has been written about the episode in order to extract appropriate lessons. It remains a puzzle the magnitude of the crisis, which developed contradicting many authorised analysts' opinion, and trapped foreign lenders and investors.

Furthermore, when the mounting disequilibrium seem on hindsight to have been evident, the Argentine government, the IMF, as well as domestic and external economic agents, apparently, failed to recognise reality and took disputable decisions. We deal precisely with this issue providing an explanation complementary to previous work, as e.g. Gurtner (2004, 2003), Bleaney (2004), Izquierdo (2002).

The objective of this paper is to explore objective causes of errors in perceptions of the exports response to trade liberalisation, which in the particular case of Argentina, gave rise to misleading projections upon the long-run solvency path and the optimal borrowing level of the economy. Focus is placed on the determinants of an unsustainable optimally chosen growing rate of net foreign assets, arguing that the case probably was that policymakers and economic agents took decisions under an "optimistic" vector of state variables characterising the model.

a. Stylized facts on Argentine export performance and the current account (CA)

After a successful and promissory trade liberalisation episode during the 1990s, Argentina started to accumulate dollar-denominated debt at a rate only consistent with paths of "optimistic" export projections. However, we think that attention must be drawn to historical evidence since the 1950s, because it suggests that the tradable sector was too small to build an expected "big and lasting" change in export performance without sizeable prediction risks. Let us review some main historical developments of the Argentine external accounts and exports flows to provide a comprehensive perspective of the crisis: recurrent external problems show the external vulnerability of the economy, through an observed low and fairly stable exports-to-GDP ratio. Thus this structural restriction implies that long-term debt levels consistent with solvency are restricted and go beyond that level only at the cost of an external crisis. Consider the three following facts.

First, regarding external equilibrium, CA reversals in Argentina have historically been a relatively frequent episode with accompanying dramatic adjustments in consumption through a sharp shrink in imports produced by the expenditure switching mechanism. Table 1 provides as a stylised fact that the Argentine external equilibrium is highly fragile; in particular, there are nine episodes of reversal in the 69 years for which data are available between 1935 and 2002; one every 7.7 years.¹

¹ Cfr. Díaz Cafferata, Kohn and Resk, 2005. A reversal is identified by a change in the CA_t to GDP_t ratio greater than a yearly variation of 2.48%, since the Argentine CA moves in a band with lower values than the 4% used in Edwards (2004).

TABLE 1

Argentina. Reversions of the Current Account (Changes $\geq 2.48\%$ *)

Year of reversion	1939	1950	1953	1963	1973	1976	1988	1995	2002
$\Delta CA\%$	-4.51	-2.67	-6.64	-4.07	-3.02	-3.61	-2.82	-2.51	-7.67
$\Delta GDP\%^{**}$	2.05	-0.05	0.00	-1.98	2.91	-0.30	0.32	1.40	-7.71
	3.41	-0.67	5.59	9.73	2.36	1.47	-4.42	6.81	8.93

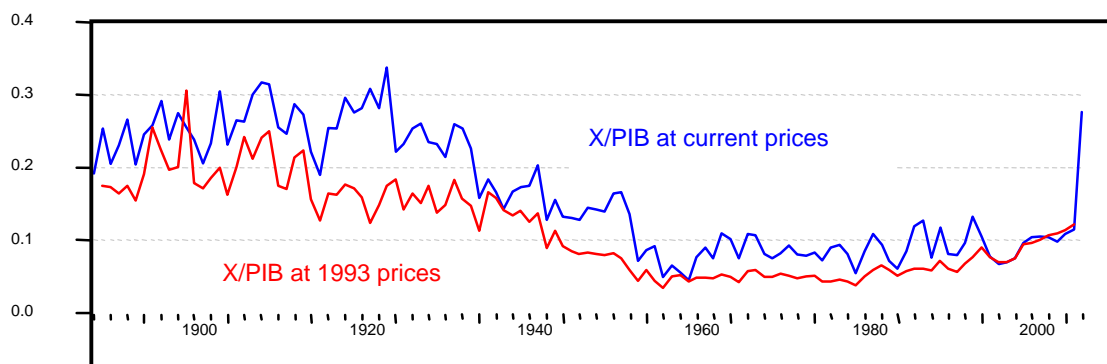
Source, Díaz Cafferata, Kohn and Resk, 2005.

* Average of CA in deficit years.

** % average change in GDP in pesos considering two years before and after the reversal.

FIGURE 1

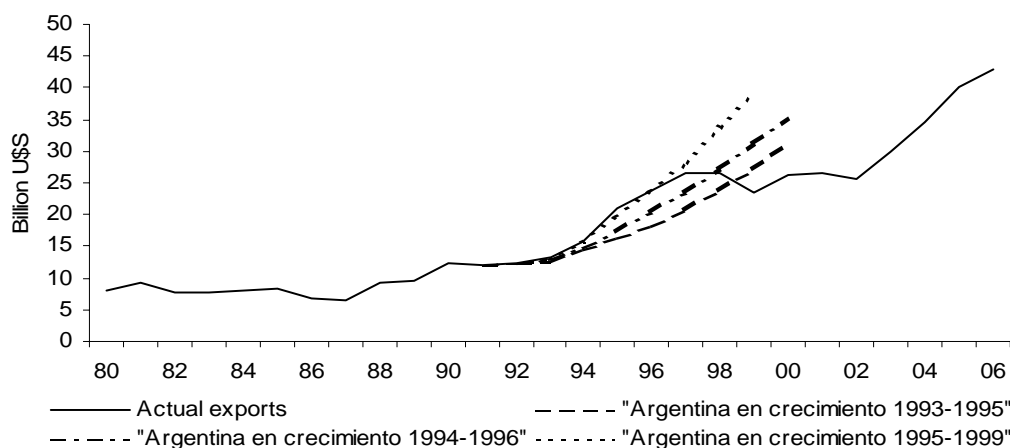
Argentine export performance. Exports to GDP ratio. Current and constant 1993 prices (in Argentine pesos). 1884-2001.



Source, Díaz Cafferata and Fornero, 2003.

FIGURE 2

Argentine goods exports. Increasingly optimistic exports projections made by economic authorities in 1993-1995, and break in tendency of actual exports. Billion current dollars.



Source, Díaz Cafferata (1996); updated by the authors. 2005 is provisional, 2006 is estimated.

The set-up in 1993 and 1994 provides alternative simulations; Figure 2 depicts in each case the benchmark scenario; the 1995 issue has a single predicted path.

Second, casual observation of the Argentine long-run path of exports-to-GDP ratio in Figure 1 shows since the period of “classical” specialisation and rapid growth (1880s) three decades with exports ratios between 20% and 30%, followed by a decline after the WWI, until the end of the 1940s; and from then on exhibits a fairly stable level below 10%. This historical behaviour is a consequence of two types of factors: (i) the determinants of the structural degree of openness of the economy or “primary causes”; and (ii) economic policies. A movement in the ratio caused by a reduction in tariffs is bounded by its long-run “free trade” level, which may change only as a result of a structural transformation of the economy.²

Third, Figure 2 shows Argentine exports between 1980 and 2006, together with three alternative expected exports trajectories from the official publication “Argentina en crecimiento” successively in 1993, 1994 and 1995. The latter two, corrected 1993 projections upward, accompanying observed exports growth. The expectation of such dynamic exports growth was based on the conviction that it was the natural response to the trade liberalisation and macroeconomic policies, and provided consistency to other evolutions in the economy, such as the rise in investment, growth of GDP, a fall in unemployment and also external solvency in spite of rising total debt. From 1996 onwards, however, the export boom came to a halt, creating a mounting gap between the expected and the “true” exports value of sizeable magnitude: while a continuation of the trend as expected in 1995 would have provided in the year 2000 an amount of about 50 bill. U\$S from exports proceeding, actual exports were only 26.3 billion dollars, around one half of the “optimistic” projection. Even the most recent figures of total exports are below that threshold: in 2005 they were 40.1 bill. U\$S and may reach 42.9 bill. U\$S in 2006.

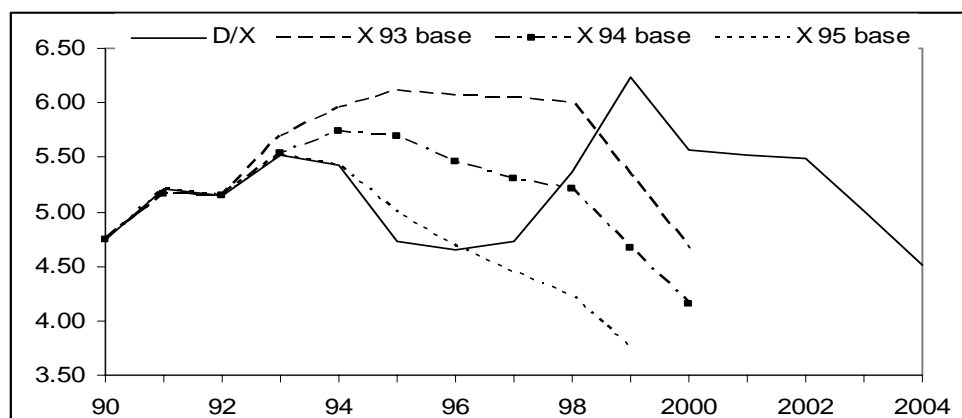
Table 1 and Figures 1 to 3 lead to suggest that Argentina is highly vulnerable to external shocks because of strong structural restrictions. In addition, the exports-to-GDP ratio has evolved rather rigidly in the last half of the XXth century. All together, suggest that deviations of external debt away from a “sustainable” debt to exports ratio turn an external crisis highly probable. In particular, when the structural X/GDP was perceived permanently rising as a response to trade liberalisation (in the first half of the 1990s), indeed the observed higher external indebtedness was minimized and judged as it would not harm the Argentine solvency position.

This argument is consistent with what Figure 3 shows: the actual debt to exports ratio was about 70% higher in 1999 than the value of the ratio computed with actual debt and projected exports in 1995. Empirical content is given in this way to the idea of ‘optimism’ regarding the solvency restrictions to borrow, with general implications for the management of an opening strategy and a policy strategy regarding capital mobility.

² A comparison of the values at current prices and constant prices shows the presence of secular overvaluation, a general phenomenon noted by Michaely (1984).

FIGURE 3

Argentina, actual values of debt-to-exports ratio, 1990 – 2004, and ratios of actual debt over exports projections.



Source, external debt is from the data appendix of Lane and Milesi-Ferretti (2006) and exports of goods and services from INDEC <http://www.indec.gov.ar>.

This paper uses a DSGE model to explore formally the consequences of the export projection errors. Our contribution hinges on building a plausible scenario and performing simulations in which foreign assets accumulation are influenced by exports measured with a projection error -in comparison with the “true” exports sequence. A modified version of the model developed in Fornero (2006) and Plasmans *et al.* (2006b) to which we refer for the details, portrays one small and one large economy, incomplete assets markets and Central Banks (CB) apply a simple Taylor rule with smoothing; the representative consumer maximises utility derived from consumption and real balances, and faces disutility when offering monopolistically hours to the labour market. Firms are monopolistic competitors of varieties. Nominal prices and wages are rigid in the short run and pricing is à la Calvo, changing them whenever an exogenous random signal is received.

Specifically, various relevant scenarios are built to perform an exercise that tackles the issue of the effects of a negative shock in the exports price which is perceived by policymakers as transitory, though indeed it is permanent.

We find support to our argument simulating a one-and-for-all shock in exports prices. Under the hypothesis of error in the forward-looking perception of the exports performance, the instantaneous bond expansion is highly amplified (two-times in our exercise), as shown by the impulse response functions.

The model structure is log-linearized using standard techniques and then calibrated to resemble features of a small open economy like Argentina. The exercise is not intended at this point to explicitly replicate the Argentine economy, but may nonetheless; provide insights about how the compounded general equilibrium effects may amplify unexpectedly incorrect decisions.

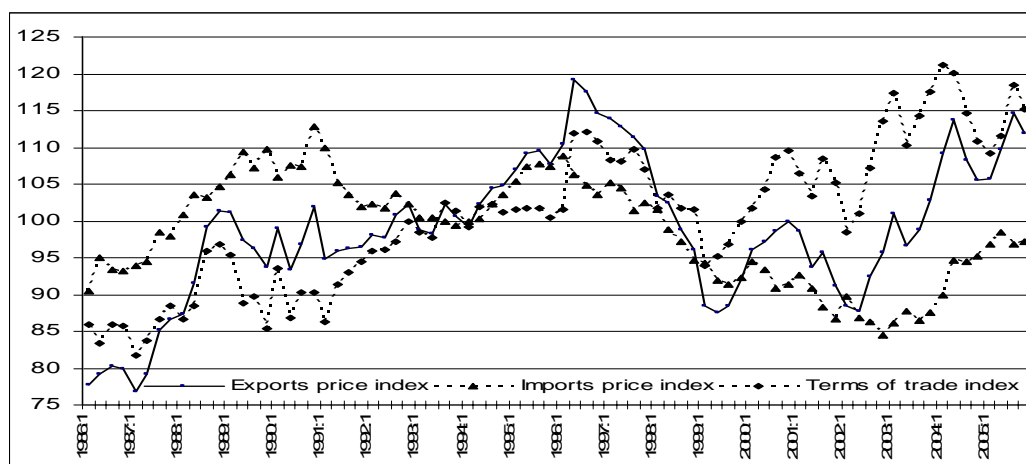
The structure of this paper is as follows: section 2, briefly reviews the volatility in international price of Argentine exports and the theoretical implications of such shocks in a model of a small open economy; section 3 explains the main features of the DSGE model; section 4, discusses the specification of the exports price shock and the options and choices of parameterization; section 5 presents the impulse response functions of CA and Foreign Bond Accumulation relative to tradable output (FBA). Section 6 concludes.

2. TERMS OF TRADE TRENDS AND SHOCKS IN DEVELOPING COUNTRIES

To examine the interactions between the real and the financial sector of the economy that may affect the CA, focus is placed on shifts in exports price, which generate incentives to increase exports, alter relative domestic and foreign prices, the exports value, real income and international lender's perceptions about the ability to pay debt services in hard currency. This is a relevant case for developing economies, which are typically subject to a high volatility in their exports price and international terms of trade. As shown in Figure 4, these wide swings notably happened in Argentina during the 1990s. The exports price index went up from the 77.7 in the first quarter of 1986 to 101.2 in the first quarter of 1989 with an increase of 30.2 %. From then on, it continues increasing but at a lower rate till it reaches a peak in the first quarter of 1996. The increase of the exports price index from the beginning of the Convertibility stabilization plan to the 1996 peak was 25.5%. A sharp drop after that peak of roughly 27% measured in the second quarter of 1999. A temporary improvement took place between 1999 and the beginning of 2001 to downturn again to a new minimum nearly when the 2001 Crisis started. From the fourth quarter of 2001 till the (preliminary figures) second quarter of 2006, the exports price did not cease to grow and during all this period it grew 31.28%. The analysis of Figure 4 suggests that Argentina is subject to great up and down oscillations of the exports price index in the short-run. This price effect is underlying the growth deceleration in the exports value observed after 1996 in Figure 2. Therefore, we consider that the exports price index is a good candidate to be modelled as an exogenous variable subject to a shock for the case of Argentina.

FIGURE 4

Argentina, terms of trade, export and import prices 1986 – 2005 (1993=100)



Source, www.indec.gov.ar.

a. Current Account effects of exports price shocks.

Basic debt issues may be addressed in intertemporal models with a single commodity, which are useful to highlight the operation of relative prices between different points in time. However, the assumption that the relative sectoral "intratemporal" price is constant may bring misleading implications when wide shifts in relevant prices are the rule. In our model both the intertemporal and intratemporal

dimensions are present. We introduce three different types of goods aggregating varieties of tradeables and non-tradeables at each point in time.³

b. Different assumptions in international trade models: real and financial markets, terms of trade effects.

Previous seminal works of Obstfeld (1982), Edwards (1987, 1989) and others, focused mainly on a framework of real business cycle with two goods and perfect foresight expectations. These models produced two main predictions:

- (i) a positive permanent shock in the terms of trade, increases consumption to a new level but saving remains unchanged; and
- (ii) when a temporary shock hits the economy, the adjustment in savings and consumption is smoothed throughout all periods.

Obstfeld and Rogoff “redux” emphasised the academic trends towards the explicit formulation of micro-foundations, and incorporating rigidities, to provide a richer perspective of the exchange rate behaviour with the intertemporal approach of the CA.

Macroeconomic models differ according to assumptions such as intersectoral factor mobility and the number of factors, the number and international mobility of goods, the structure of production, and the -endogenous or exogenous- flexibility and formation of prices and factor returns. Relevant assumptions underlying the model that we further develop in Section 3.

Regarding the **size of economies**, to the small-large standard dichotomy added features in the analysis incorporate a centre-periphery or North-South classification and the Prebisch-Singer hypothesis of declining terms of trade. And different focus on the dynamics stress comparative static, or transition and steady state effects on dynamic models, to name a few. The literature has examined extensively the welfare effects in all these multiple different theoretical settings and the policy implications thereof.

Further, the degree of **financial mobility** is incorporated in the model through a parameter that measures the friction in the asset markets faced by the foreign investor, which is a function of different information sets of the home and foreign investor. For simplicity, we assume that the information set is identical for all individuals but there is an asymmetry operating when the foreign investor purchases home bonds.⁴ The nature of the shock can have different dynamics, it ranges from the very simple and basic results provided by real models in which trade is balanced and price shocks are once-and-for-all known with certainty; to our model where exogenous variables are purely stochastic and persistent.⁵

Last, the **assets structure**, with either complete or incomplete markets is a critical feature of the model because under complete markets the possibility to pool all risks

³ A feature that is useful to explore the implications of phenomena like the overvaluation of the real exchange rate or the changes in terms of trade, that were central to the operation of the Argentine economy in the 1990s.

⁴ A related analysis concerns capital movements in relation with the volume and the pattern of goods trade. One known prediction is that capital exports improves the terms of trade of a country specialized in capital goods. (Ruffin, 1984, p. 286) We discuss this point later on allowing for different degrees of capital movements.

⁵ Corden (1984) remarks that additional assumptions about price flexibility and policy intervention are behind real models, where balance of trade equilibrium and full employment are *always* maintained.

makes state contingent income to become constant for all households, contrary to the case of a bond economy, which can only smooth consumption.

Our dynamic stochastic general equilibrium model –DSGE onwards- adds a complex structure in the set up providing richer theoretical dynamics. Understanding how different shocks spreads in the economic system is useful for policy analysis. In the particular application of this paper, we simulate different degrees of persistence in exports price shock, in order to assess the effect of an error in the perception of a shock understood as temporary but indeed permanent.

Permanent and transitory changes in terms of trade

To assess the effect of terms of trade shocks, we distinguish between permanent and transitory changes. The perception of whether a terms-of-trade shift is of one or the other type is determinant of the response by economic agents but also, as we shall argue, they may err on this matter. One case is mistaking transitory for a permanent shift in terms of trade; the other one is to perceive with a lag the change in direction of the price variable.

Obstfeld (1982) provides an intertemporal perfect-foresight optimizing model that compares transitory and permanent terms-of-trade shocks on a small open economy's CA. Two different channels drive the CA response to the shock, one is the smoothing consumption motive, the other is the agents' knowledge that the real value of the debt will change after the temporary disturbance to the terms of trade ceases.

A shock effect can vary widely in terms of duration that produces in the endogenous variables. It ranges from purely transitory to permanent effects (in the other extreme).

If there is an unexpected *permanent* terms of trade worsening, the long-run bond level does not change and the costate variable, that is interpreted as the shadow price of bonds in utility terms, rises instantly to its new stationary level. Obstfeld notes that under the assumption that the subjective time-preference rate is constant a permanent fall in real income elicits an equal cut in spending⁶.

When the worsening of the terms of trade is *transitory* the shadow price of bonds rises, and households borrow during the temporary fall in real income until the terms of trade return to the long-run level; after this point the economy repays the debt, having accomplished a smoothing of its consumption path.

Notice that Obstfeld works out a model with the particular solution of perfect foresight expectations, while the stochastic model underlying the main conclusions in this paper uses extensively rational expectations for forward looking variables. The model is solved (for paths of shocks of different durations) in the expected paths and the source of uncertainty is precisely that the policymaker does not know the duration of the shock. The exports price shock *differs from shocks in other exogenous* variables (e.g. technological shocks) since it does not depend on a stochastic law: we categorize the duration of the exports price shock as permanent or transitory.

The simulation analysis performed here is based on impulse-response functions of the general equilibrium effect of transitory or permanent under uncertainty, to discuss their role and relevance on deciding optimal external borrowing. Two particular features are worth pointing out: in addition to the usual distinction between

⁶ An opposite outcome is possible if the time preference rate is an increasing function of current instantaneous utility.

permanent and temporary shocks, we work out the possibility that a transitory shock may be mistakenly perceived as permanent; the interest rate paid by a borrowing economy is assumed to be an increasing function of the aggregate net indebtedness. We pose two specific questions. Firstly, by which channels and to what extent do permanent or transitory shifts in the terms of trade influence external borrowing decisions? Secondly, under which circumstances rational agents may take unsustainable borrowing decisions? We will skip the possibility of deliberate cheating to concentrate in the possibility that rational agents make errors in the perception of the exports price shock, and the consequences thereof.⁷

3. THE MODEL

a. *General features*

Let us describe now the structure of the model used for the simulations.

Our DSGE of a small open economy is built on three main parts: consumers, firms and policymakers decisions. Since the model is highly non-linear and no closed form solution is feasible, it is solved and simulated in the log-linearised form for 73 endogenous variables and 9 exogenous shocks: in domestic nominal exchange rate, in (home and foreign) technology both tradable and non-tradable goods, in (home and foreign) money supply, in exports measurement error, and in the domestic exports price. Key features of the model are the following: (i) there are two open economies, producing tradable and non-tradable goods, one small representing 1% of the global economy, and the rest of the world, allowing for a (small) feedback from the small economy;⁸ (ii) the representative consumer maximizes utility derived from consumption and money balances, and faces disutility when offering hours to the labour market. Habit formation, brings about a hump-shaped impulse response functions of consumption;⁹ (iii) nominal rigidities in the short-run are allowed in varieties of goods and labour prices in a monopolistically competitive environment. As a shortcut to maintain tractability, the Calvo pricing rule is assumed: at the beginning of each period, an exogenously determined fraction of firms (workers) quote new prices (wages). These firms (workers) along with the remaining ones that hold prices (wages) fixed must satisfy demand during the period. When a shock hits the economy, prices (wages) change in a staggered form and that brings about short-run real effects derived from monetary policy. An exogenous probability allows firms to update (re-optimizing) prices. Since the problem is forward looking the current price (wage) depends on sequences of expected endogenous variables. Labour market is in full employment; (iv) Capital is specific to firm i , fixed and normalized to one for simplification;¹⁰ (v) Concerning macroeconomic policy, it is assumed that

⁷ The default in sovereign debt may be seen as a consequence of inescapable difficulties to honor external obligations, or as a decision game involving a benefit-cost trade-off.

⁸ The two sectors structure prevents the equalization of the purchasing power parities in the economies holding. This is so, since non-tradable sector inflation may not evolve as the general inflation, independently of the pricing strategy, e.g. LCP vs. PCP. Lee and Chinn (2006) find evidence that supports the two sector modelling approach versus one good to generate meaningful impulse response functions using VARs with a minimum number of restrictions.

⁹ In Furher (2000), it is shown that the simple permanent income model is unable to replicate this "hump-shaped" form observed in empirical studies for consumption.

¹⁰ In the literature, there is no consensus about the contribution of cost of adjustment of investment to the hump-shaped form in responses of endogenous variables. Since nondurable goods and services output account for more than 60% of the GDP and are reasonably low capital intensive.

governments follow a zero-deficit budgetary rule and the central banks –CBs- are committed to a monetary policy rule of the Taylor type for open economies. The CB manages the nominal interest rate as the instrument to mitigate deviations inflation, of NT and T output and exchange rates from their respective steady state values. The home CB is committed to a peg with anchor being the large country currency. It supplies the necessary quantity to meet the demand and clear the money market.¹¹ The above features are explained in detail in Fornero (2006) and Plasmans *et al.* (2006b). In the next section, we comment and stress the main building blocks of the model: consumers, firms, the government, CB and equilibrium conditions. The parameterization reflects consistently a small and a large economy and we carry out simulation exercises in which we show that over-borrowing is possible.

b. Demands, production and economic policy

Consumer and Government Demand. Aggregation

The world economy is populated by a continuum of infinitely living consumers normalized to 1. Home and foreign representative consumer, indexed by $j \in [0, \varphi]$ and $j^* \in [\varphi, 1]$, produce and trade varieties of goods. Home and imported tradable goods, H and F , and non-tradable goods, NT , are mutually exclusive aggregates of integrating varieties over $h \in [0, \varphi]$, $f \in [\varphi, 1]$, and $n \in [0, \varphi]$, respectively. Each region has an administrative authority which imposes taxes and spends them in non-tradable goods and transfers. The consumption bundle C_s is specified as a Constant Elasticity of Substitution-CES- index,¹²

$$C_s = \left[\gamma^{\frac{1}{\eta_c}} C_{T,s}^{\frac{\eta_c-1}{\eta_c}} + (1-\gamma)^{\frac{1}{\eta_c}} C_{NT,s}^{\frac{\eta_c-1}{\eta_c}} \right]^{\frac{\eta_c}{\eta_c-1}}. \quad (1)$$

And the consumption of tradable varieties as $C_{T,s}$.¹³

$$C_{T,s} = \left[\varphi^{\frac{1}{\eta_t}} C_{H,s}^{\frac{\eta_t-1}{\eta_t}} + (1-\varphi)^{\frac{1}{\eta_t}} C_{F,s}^{\frac{\eta_t-1}{\eta_t}} \right]^{\frac{\eta_t}{\eta_t-1}}. \quad (2)$$

Prices are the solution that minimizes the expenditure necessary to buy a unit of the relevant bundle. The demand structure together with prices definitions are presented in the appendix. Two key equations of the model are the utility function and the budget constraint; household j behaves rationally maximizing the expected discounted period (additive separable) utility,

$$\tilde{U}_t^j = E_t \sum_{s=t}^{\infty} \beta^{s-t} \left[\frac{1}{1-\sigma} \left(\frac{C_s^j}{(C_{s-1}^j)^b} \right)^{1-\sigma} + \chi \xi_s \left(\frac{M_s^j}{P_s} \right)^\varepsilon - \left(\frac{(N_{H,s}^j)^{1+\iota} + (N_{NT,s}^j)^{1+\iota}}{1+\iota} \right) \right], \quad (3)$$

subject to the following dynamic budget constraint in real terms:

¹¹ Mohanty and Klau (2005) find evidence that the exchange rate contributes more than output (but less than inflation) to responses of interest rates for developing countries.

¹² γ and $(1-\gamma)$ are shares of T and NT consumption in C_s with elasticity of substitution $\eta_c > 0$.

¹³ φ and $(1-\varphi)$ are shares of H and F goods in $C_{T,s}$ with elasticity of substitution $\eta_t > 0$.

$$\begin{aligned}
& \frac{(1-\tau_w)(W_{H,s}^j N_{H,s}^j + W_{NT,s}^j N_{NT,s}^j)}{P_s} + T_s^j + \frac{(1-\tau_D)(D_{H,s} + D_{NT,s} + D_{M,s})}{P_s} \\
& \geq C_s^j + \frac{M_s^j - M_{s-1}^j}{P_s} + \frac{1}{P_s} \left(\frac{B_{s+1}^j}{1+I_s} - B_s^j \right) + \frac{1}{P_s} \left(\frac{\xi_s B_{s+1}^{*j}}{(1+I_s^*) \Phi\left(\frac{\xi_s B_s^{*j}}{P_s}\right)} - \xi_s B_s^{*j} \right). \tag{4}
\end{aligned}$$

Utility in eq. (3) depends positively on consumption (which features habit formation with constant relative risk aversion –CRRA–), and money balances, and negatively on hours worked in both sectors, $N_{H,s}^j$ and $N_{NT,s}^j$. The substitution in consumption in the economy is given by demand elasticities, and the intertemporal choices are influenced by the discount factor in eq. (3). $\sigma > 0$ measures agent's disposition to take risks and is the inverse of the intertemporal elasticity of substitution in consumption.¹⁴ The parameter $b \in (0, 1)$ stands for persistency in consumption –habit–, ε is the elasticity of demand of money and ι is the inverse of the elasticity of substitution of work effort respect to real wage, and $\beta \in (0, 1)$ is the discount factor.¹⁵

The LHS of (4) is the agent's real income: wage income net of tax; real dividends net of taxes of home producers and importers; expected real returns on home-issued bonds holdings and real transfers from the government. In the RHS we find the uses: consumption, variation in the stock of money holdings and variation in the stock of home and foreign bonds.¹⁶ Note that home financial assets are per capita nominal dividend-coupons $D_{H,s}$, $D_{NT,s}$, $D_{M,s}$ and money.¹⁷

Following Woodford (2003, p 65), the *home asset* (securities and dividend-coupons) market is *complete*, while the worldwide bonds market is incomplete: the known envelope theorem, all *home and foreign* investment alternatives bring about an equal real return at the optimum. Therefore, we denote the value of the portfolio by B_s^j and we treat them as one asset as Plasmans *et al.* (2006a).¹⁸ Households demand foreign bonds B_s^{*j} , to finance foreign trade deficits; it has a return with a "premium", Φ , such that the uncovered interest rate (UIP) condition does not hold in the short-run.^{19,20} The premium depends positively (but in a decreasing manner) on the net foreign asset position (NFA) -the negative of the cumulated balances of the CA.²¹ Thus, the return the investor gets abroad is $(1+i_s^f) = \Omega_s(1+i_s^*)$, where

¹⁴ Cfr. Obstfeld and Rogoff (1996), chapter 5.

¹⁵ Note that utility is concave in C and M/P (once innovation ξ_s is known) and convex in N .

¹⁶ Notice that bonds are measured at the beginning of the period and it is assumed that this information is known.

¹⁷ Real home per capita dividends are given by $\frac{1}{\varphi P_s} \int_0^\varphi [\mathfrak{B}_{H,s}^i + \mathfrak{B}_{NT,s}^i + \mathfrak{B}_{M,s}^i] di$ adding up all types of firms i benefits.

¹⁸ Since households are exposed to the same risks and they pool risks into the same asset's set, assuming identical initial wealth implies that wealth is evenly distributed. Consequently, all households are symmetric and we can drop the index j in variables.

¹⁹ The bond is denominated in issuer's currency and it is traded worldwide.

²⁰ Formally, the UIP condition is $(1+I_s)E_s[P_s/P_{s+1}] = \frac{(1+I_s^*)}{\Phi\left(\frac{\xi_s B_s^{*j}}{P_s}\right)} E_s\left[\left(\frac{\xi_{s+1}}{\xi_s}\right)\left(\frac{P_s^*}{P_{s+1}^*}\right)\right]$.

²¹ Formally, $\Omega_t \equiv v_t \Phi(\bullet)$, $\Phi(0) = 1$, $\Phi'(\bullet) > 0$ and $\Phi''(\bullet) < 0$. Notice that it is assumed that the other country is not facing any premium when investing in home, or $\Phi^*(\bullet) = 1$.

$\Omega_s \equiv v_s \exp\left(-\Xi\Phi\left(\bar{\epsilon}_{s+1}B_{s+1}^*\right)/\bar{\epsilon}_s P_s^C\left(\frac{P^X Y^X}{P^C}\right)\right)$ is greater than one unless $B_{s+1}^* = 0$.²² In particular, the wedge between returns depends on the real NFA position, steady state real foreign imports, $\frac{P^X Y^X}{P^C}$, and on a parameter which captures the degree of capital mobility. Since it is assumed that v_t is an *iid* process centred in 1, when $\Xi = 0$, the capital mobility is perfect. Therefore, once we allow either for perfect capital mobility or NFA zero, UIP holds with purely temporary deviations. First order conditions are derived in Fornero (2006) and Plasmans *et al.* (2006a).

The supply block: input demands, aggregation and pricing.

The home economy produces: tradable T, and non-tradable NT goods, using all varieties of labour. There are also importers, which purchase goods in the global market, repackage and give a new brand, and sell them domestically. Capital is also an input but is fixed and specific to the firm. Formally, the production of a (representative) home T (NT) firm, $i \in [0, \varphi)$, is given by the production function

$Y_{H,s}^i = \Omega_{H,s} \left(N_{H,s}^i\right)^{\zeta_H} \left(Y_{NT,s}^i = \Omega_{NT,s} \left(N_{NT,s}^i\right)^{\zeta_{NT}}\right)$, where $N_{H,s}^i$ and $N_{NT,s}^i$ is the quantity of labour input used. Notice that ζ_H (ζ_{NT}) is the share of the T (NT) wage bill over the total T (NT) firm's output. The exogenous technological change is assumed neutral-augmenting.

The home technology $(\Omega_{H,s}, \Omega_{NT,s})'$ follows a stochastic VAR(1) model with an *iid* error $(\zeta_{H,s}, \zeta_{NT,s})'$, mean $\mathbf{0}$ and variance-covariance matrix $\mathbf{Diag}(\sigma_{\zeta_H}^2, \sigma_{\zeta_{NT}}^2)$.

Firms are assumed that re-optimize once they receive a randomly generated signal. Each sector follows a different and independent Calvo price rules, that make price indices staggered. We refer the reader for the details to Fornero (2006) and Plasmans (2006a).

The pricing of inputs is as follows. Wages are quoted by the agent who is a monopolist supplier of working hours. The quotation of wages follows a Calvo wage rule similar to final goods pricing rule.

Fiscal and Monetary Policy

The government purchases NT goods, $G_{NT,s}$, grants lump-sum transfers, T_s^j , and is committed to a zero-deficit budget rule adjusting taxes accordingly. Its budget constraint is:

$$\int_0^\varphi T_s^j dj + G_{NT,s} + \frac{\Delta M_s}{P_s} \leq \frac{\varphi}{P_s} \left[\tau_M (\bar{\epsilon}_s P_{F,s}^* C_{F,s}^*) + \tau_w (W_{H,s} N_{H,s} + W_{NT,s} N_{NT,s}) + \tau_D (D_{H,s} + D_{NT,s} + D_{M,s}) \right].$$

The aggregated money demand $\int_0^\varphi M_s^j dj$ must match the supply –indirectly controlled– from the CB to obtain the equilibrium in the money market. The instrument

²² Benigno (2001) rationalized this wedge as the necessary cost that intermediaries ask for their consultant services in the foreign capital markets. Turnovsky (1994), rationalizes the premium as the country risk of developing countries that is in proportion to the debt position. However, the *perception* of the ability to repay the marginal debt may turn the risk premium and the domestic interest rate highly volatile. Therefore, he concludes that at optimal debt position the rate of time preference is equal to the domestic interest rate.

that the CB sets in order to conduct monetary policy is a one-period-maturity risk free bond with nominal return denoted by I_s .

Following Natalucci and Ravenna (2002), home MP is specified as an open-economy version of the Taylor rule,

$$\frac{1 + \widehat{I}_s}{1 + \bar{I}} = \left(\frac{1 + \Pi_{s-4}}{1 + \bar{\Pi}} \right)^{\vartheta_{\pi_{CPI}}} \left(\frac{Y_{T,s}}{\bar{Y}_T} \right)^{\vartheta_{Y_T}} \left(\frac{Y_{NT,s}}{\bar{Y}_{NT}} \right)^{\vartheta_{Y_{NT}}} \left(\frac{E_s}{\bar{E}} \right)^{\vartheta_E} \quad (5)$$

where parameters $\vartheta_{\pi_{CPI}}$, ϑ_{Y_T} , $\vartheta_{Y_{NT}}$ and ϑ_E are non-negative and represent the feedback coefficients to CPI inflation, sectoral outputs and the nominal exchange rate.²³ The CB intervenes in the bond market to correct deviations of these variables from their steady state values, and the barred variables denote those variables evaluated at the steady state. Notice that a reaction when $\vartheta_E \rightarrow \infty$ is consistent with a fixed exchange. We assume that the CB pursues also a smooth interest rate, so that the observed interest rate in the short run is a weighted geometrical average of the targeted, \widehat{I}_s , and the previous interest rate: $1 + I_s = (1 + \widehat{I}_s)^{1-\chi} (1 + I_{s-1})^\chi \exp(\varepsilon_{MP,s})$, where the I_s is the targeted interest rate. The weight in the previous period interest rate is χ and $\varepsilon_{MP,s}$ is an exogenous shock to MP follows an *iid* process centred in zero.

c. Equilibrium

Benigno (2004) shows that under the assumption that in the model economy to invest in foreign bonds is as costly as in a domestic bond, that: (i) consumption is stationary; (ii) the international traded bond is redundant; and (iii) it is predicted perfect risk sharing in consumption.

In contrast, we assume *imperfect* risk sharing following the ideas of Benigno (2001) and Kollmann (2002), explained in Section 2.b. The NFA accumulation has effects in the consumption sequence and since the exchange rate adjusts (influencing the needed expenditure switching effect) in order to prevent NFA from exploding.

In particular, the problem of the private agent is fully described (therefore it is solvable) through the maximization of the utility (3), subject to the budget constraint (4) and the transversality condition, given:

(i) initial conditions of wealth (solely assets) and prices $P_{H,t-1}$, $P_{F,t-1}$ and $P_{NT,t-1}$;

(ii) price sequences $\left\{ P_{H,s}, P_{F,s}, P_{NT,s}, P_{NT^*,s}, P_{H,s}, P_{F,s}, P_{NT,s} \right\}_{s=t}^{\infty}$ and incomes

$\left\{ (1-\tau_w)w_{H,s}, (1-\tau_w)w_{NT,s}, (1-\tau_D)(D_{H,s} + D_{NT,s} + D_{M,s}), T_s \right\}_{s=t}^{\infty}$; and

(iii) the sequence of shocks ξ_s .²⁴

²³ Despite the fact that during the 1990s in the CB of Argentina conducted almost no active monetary policy, this paper analyses the current situation of Argentina and of many Latin American countries, which follow inflation targeting using variations of the Taylor rule (5).

²⁴ The optimality conditions are sufficient when the budget constraint is exhausted and the solution is "interior".

4. SIMULATING THE EFFECTS OF AN EXPORTS PRICE SHOCK WITH AND WITHOUT PERCEPTION ERROR

a. Parameterization

In order to simulate the response in endogenous variables specially the CA and the FBA, we calibrate the model described in the previous section with parameters that are chosen to resemble the case of a (small) country.

First, notice that the (small) home CB sets the interest rate according to an open economy Taylor rule (5). It conducts **monetary policy** reacting to annual inflation, to the tradable and non-tradable output deviations from their steady states, and to the current exchange rate depreciation, with parameters, $\vartheta_{\pi_{CPI}}=1.5$, $\vartheta_{Y_T}=\vartheta_{Y_{NT}}=0.5$, and $\vartheta_{\epsilon}=10000$, respectively. Reaction parameters to CPI inflation and sectoral output gaps are quite standard and were first proposed by Taylor (1993). The CB should overreact to inflation to kill the expected annual CPI inflation that is determining the actual price in the Calvo price setting rule. The large reaction implied by ϑ_{ϵ} is consistent with the peg assumption.

Second, the **consumer utility** depends on the elasticity to work effort, $\iota=0.33$, the risk aversion parameter, $\sigma=1.35$, the habit formation parameter, $b=0.65$; and the intertemporal preference to postpone consumption is $\beta=0.99$, which implies a long-run interest rate of 4% that is assumed to make consumption stationary. Moreover, the assumed elasticity to money demand is $\chi=2/3$. All the assumed values are standard and taken from the literature.

Third, parameters that are governing **frictions in price and wages** in the home economy are: (i) the tariff on the imported good, which is a trade restriction that harm the openness of the economy, $\tau_M=0.19$; (ii) tradable and non-tradable goods and wages pricing present frictions, which are proxied by the Calvo price and wage setting rules, with probability 75% of maintaining prices unchanged in the short-run, namely: $\varphi_M=\varphi_H=\varphi_W=0.75$. These probabilities are consistent with an average rigidity of prices and wages of one year. Moreover, our model features frictions in capital markets, captured by the parameter Ξ . We set $\Xi=0.003125$ for Argentina, following Lane and Milesi-Ferretti (2001). The smaller the parameter indicates the lower friction and consequently a more rapid arbitrage between home and foreign bonds returns.²⁵ We find interesting to simulate the case of a SOE with higher restrictions to the mobility of capitals. For instance, Chile applied extensively in the 1970s the Tobin's tax to foreign investments. To consider this case, we simulate the exports price shock for the case of Chile, with $\Xi=8/1600$ or 60% relatively more friction.

Fourth, the **substitutability** in the demand is given by the elasticity of substitution. It involves in the first level of aggregation T and NT, assumed to be $\eta_c=1.25$, while at the second (tradable) level the elasticity of substitution between H and F is $\eta_t=1.85$. Moreover, the SOE T and NT shares in the demand of total consumption are assumed to be symmetric, i.e. $\gamma=0.5$ and $\varphi=0.5$.

The technology is assumed the same in the SOE and in the rest of the world, with

²⁵ In the notation of Lane and Milesi-Ferretti (2001), Ξ is λ , and for the industrialized SOE the estimated friction in capital mobility is $0.03/1600=0.001875$.

decreasing returns in production with assumed sectoral shares: $\nu_T = \nu_{NT} = 0.98$.²⁶

The **foreign** country is symmetric both in calibration and structure. However, it is assumed that since the foreign country is large, its CB does not care about the exchange rate w.r.t. the SOE when setting the nominal interest rate, so that $\vartheta_{\phi} = 0$. In addition, the big country faces a large home market bias. Consequently, we set the share foreign share in the foreign CPI as $\phi^* = 0.99$; which implies that the foreign CPI is largely explained by foreign tradable goods prices.

Simulation of errors in perception

To accomplish the simulation exercise we need to give formal expression to the intuitive idea of the “mistake” in the duration of a price shock, though we do not endogenize such duration. The “error in perception” shows up when comparing alternative paths generated by decisions taken by agents based on both “false” and “true” information. In particular, we analyse the consequences of the inaccurate perceptions and misinterpretation about the duration of an exports price shock, with the difficulty that there are not specific channels that may portray how and when the economic agents find out that they are in the wrong path in this model. Consequently, this exercise is a tentative solution to approximate the existence of informational errors, and the implied general equilibrium interactions by the specified model for a SOE.

In the simulation we consider the “true” duration of the negative exports price shock is permanent, and the “false” one is the perceived as temporary. Let us specify the exports price deviation from its steady state by:

$$\text{exports price deviation} = \begin{cases} p_{x_t} = \alpha p_{x_{t-1}} + \text{shock} - p_{x_t} & \text{permanent} \\ p_{x_t} = \text{shock} - p_{x_t} & \text{transitory} \end{cases}$$

where $\text{shock} - p_{x_t}$ is a stochastic variable normally distributed with mean zero and variance 0.05.²⁷ The AR(1) coefficient measures the degree of persistence in the exports price. With a negative value $\text{shock} - p_{x_t}$ we simulate the downturn in exports price that took place in the first quarter of 1996 highlighted in Figure 4.

Kent and Cashin (2003) estimate the half-life of the terms of trade shock for 128 countries in the period 1960-1999 using panel data techniques and they find for Argentina an α equal to 0.816 consistent with an estimated half life of the terms of trade shock of 3.48 years. Our sample has quarterly frequency and the AR(1) data generating process of p_{x_t} in quarters that develop a 3.48 years half life is about 14 quarters. This gives rise to a consistent autoregressive coefficient α of 0.9517.²⁸ Those shock durations, imply different responses of endogenous variables, particularly in the FBA sequence and the CA.

Consider the projections illustrated Figure 2. Our hypothesis is that Argentine agents may have taken the permanent negative shock in exports price as transitory. Then,

²⁶ The values of chosen parameters are taken from the literature, further simulations will provide insights into the sensitivity of key variables with respect to changes in particular parameters.

²⁷ The variance of the exports price log-deviation from steady state value is 0.05 in 1986-2005. The series is approximated as the difference of the exports price in logs and the respective trend is computed using the Hodrick-Prescott filter.

²⁸ To check an intermediate case, consider $\alpha = 0.8$, which is consistent with a half-life of 3.1 quarters.

the rational response is to increase today's consumption as the new level of prices is permanent, though the "true" sequence of exports prices is transitory and last only one or just a few periods.

The point we would like to simulate is that both Argentine authorities and private agents not "gut" in the model in the mid 1990s perceived there had been a structural change induced by economic policies, and that the new organization of the economy was taking advantages of the new trade opportunities and more suited and available alternatives to finance investment with external savings. Certainly, disturbances may occur, but the long run trends of the economy including GDP and exports were not subject of uneasiness and the exports prices seemed to be rising. Now, the question is which are the general equilibrium effects of a sharp and sudden fall in exports price between 1996 and 1999? Our hypothesis is that in a real model it would induce resource reallocation of variable factors and investment and changes in factor rewards à la Stolper Samuelson. In the Argentine case, there is an additional feature with implications we shall explore here: exports are influencing debt through the intertemporal budget constraint. Therefore, one might expect that the latent error in forecasting exports prices after a shock would impact in more expansion of the debt in the small open economy.

Effect on CA and FBA when the degree of financial capital mobility is endogenous.

The degree of financial capital mobility affects the CA response. The intuition is that if the interest rate in the SOE is larger than that in the rest of the world, it is more likely that an inflow of financial capitals to the SOE will lower the domestic interest rate with a larger short run response in the CA. We assume two different values of Ξ following Kollmann (2002), which are taken from estimation results reported by Lane and Milesi-Ferretti (2001).²⁹ The degree of friction in financial capital mobility is country specific. In our particular exercise, we assume that $\Xi = 0.05/1600$, which seems to be a reasonable value for Argentina during the 1990s, and we assume $\Xi = 0.08/1600$ for the case of Chile. Since the parameter Ξ measures the friction in the UIP relationship, the larger it is make more difficult the functioning of the arbitrage condition in home and foreign interest rates in the model, and this can be interpreted as a lower mobility of capital.

Effect on CA and FBA when the degree of trade openness in the SOE varies from trade restricted to open through trade liberalization.

The standard prediction is that a transitory negative shock in the exports price produces a negative CA response since the economic agent incurs in trade deficit and issue bonds trying to smooth consumption.

When the economy is quite closed and the technology shock takes place in the rest of the world the SOE will not suffer from the competence of more efficient foreign firms. In the simulations we assumed that the home government levies taxes on the imports price through an 'ad valorem' tax. The tariff increases the domestic price of foreign goods, decreasing their demand (the demand of imports becomes

$C_{F,s}^j = (1 - \varphi) \left[(1 + \tau) \bar{c}_s P_{F,s}^* / P_{T,s} \right]^{-\eta} C_{T,s}^j$, which goes down, cfr. Appendix). As usual,

²⁹ Kollmann (2002) computes the welfare maximizing Taylor-style interest rate rule in a business cycle small open economy using a capital market friction parameter $\Xi = 0.03/1600$ that suits small industrialized economies.

demands of home goods are not greatly affected (since the SOE is quite close) and real variables as e.g. GDP does not varies much w.r.t. its steady state. In opposition, when the economy has low trade barriers and international trade is almost free, we observe that the shock spreads more easily in the whole system, decreasing immediately marginal costs, and the tradable CPI index. Other frictions as e.g. Calvo staggering prices, however, are preventing full flexibility in the most aggregated CPI that captures the NT price behaviour. The tax rate chosen to conduct the simulation exercise is 19% in order to analyze the realistic case. This rough figure is relevant for Argentina (recall that the common Mercosur tariff is 14%). To compare results with the free trade case we lowered such a tariff to a negligible one of 1%, with which the system is again run.

5. SIMULATION RESULTS

In this section we present results about key external variables for the SOE. We concentrate on the implied accumulation of bonds as a consequence of overestimation of exports.

One implication of the model outlined in Section 3, is that we might expect that a positive exports price shock will raise the accumulation rate of foreign bonds since the excess of savings shift up the demand of both home and foreign bonds. In the steady state, there is no incentive to borrow or lend, then they are in zero net supply, then the response dynamics of the CA is positive and then turns negative and converges to zero as time passes. In fact, to resemble the sharp negative exports price shock experienced by Argentina in the first quarter in 1996 and illustrated by Figure 4, we simulated the opposite effect in CA.

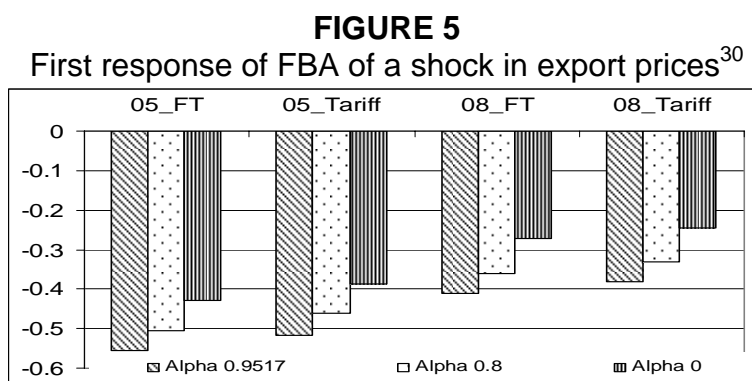
We analyze in this section the impulse response functions of the CA and the FBA. What we might expect is that a lower the degree of capital mobility and trade openness give rise to lower error in exports.

a. Discussion of bonds accumulation reaction in the SOE in the very short run

In Figure 5, we illustrate the first period response in the FBA under: (i) different duration of the shock (compare relative bars' height in each group); (ii) alternative degree of financial capital mobility for developing countries i.e. $\Xi=0.05/1600$ and $\Xi=0.08/1600$; and (iii) differential barriers to trade, where the effect of tariffs on import prices are assessed comparing each group of bars. We concentrate in two cases, one with an average tariff of 0.19 and the other with an almost negligible tariff level to capture the response in an environment of free trade. The exercise can be used to roughly replicate the liberalization episode of a small open economy.

A value of alpha equal to zero is consistent with a purely temporary exports price shock, while 0.8 and 0.9517 are consistent with half-lives of 3.5 and 14 quarters, respectively. In order to interpret the label of each group of bars, we denote with the decimal part of the numerator of Ξ what comes before “_” (for instance “05_” or “08_”); while, what follows “_” (for instance “_FT” or “_Tariff”) mean assumptions of free trade or a high import tariff. The vertical axis measures the magnitude of the first impact of the bond decumulation as a result of an export price shock with a magnitude of one standard deviation.

Considering only the first impact of the shock, the findings point out that a restriction in the mobility of capital in a liberalisation process may mitigate the overexpansion of home debt.



Source, authors' computations.

In the following section we report the impulse-response functions to the exports price shock and how these differ when we allow for variations in parameters.

b. Responses in CA and FBA after the shock impacts

In the first subsection we examine the effect in the CA once a shock in exports price takes place. The second subsection works out the shock effect on the optimal FBA response path.

General equilibrium response of the CA to shocks of different duration

Figures 6 to 8 depict the equilibrium response of the CA for the applied analysis of different duration of exports price shock. A permanent negative shock in the exports price produces a CA response as depicted in Figure 6, first a large deficit that is paid back smoothly during the following periods. The response when the shock in exports price has a half-life of 3.5 quarters is portrayed in Figure 7. If we compare both CA responses, it is apparent the higher short-run variation when the duration is smaller. Adding up the first and second quarters CA responses, transitory export price shock gives rise to more debt accumulation than permanent; however, from 3rd quarter on the latter is consistent with a smoother and more persistent response. Figure 8, illustrates the smallest response of the CA since the shock is permanent and all the bulk of the adjustment is in consumption in the very short run.

³⁰ Impulse response functions were computed using Dynare version 3.064 in Matlab 7 environment. Dynare is a very powerful public set of routines designed to simulate and estimate DSGE models.

Figure 6

Response of the CA to a *purely temporary* ($\alpha=0$) shock in exports price

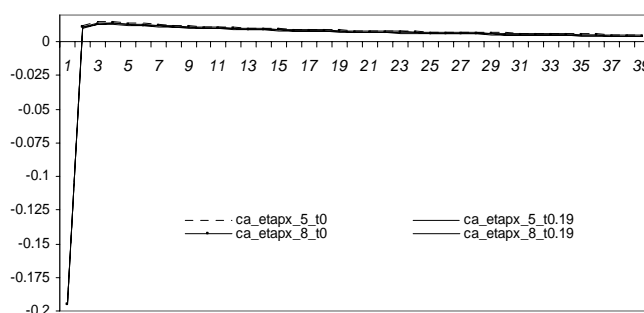


Figure 7

Response of the CA to a *permanent* ($\alpha=0.8$) shock in exports price

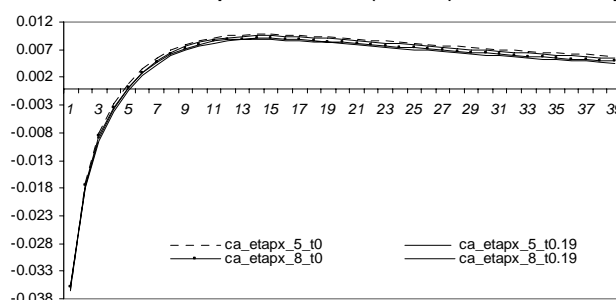
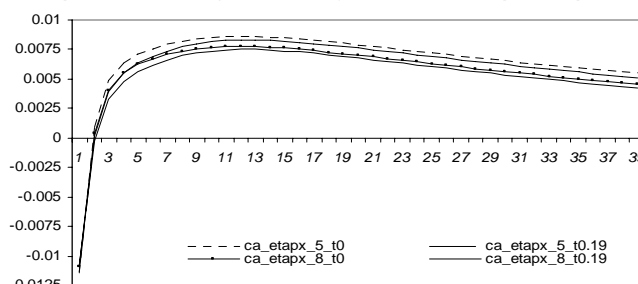


Figure 8

Response of the CA to a *permanent* ($\alpha=0.9517$) shock in exports price. Half-life 14 quarters.



Response of accumulated foreign bonds to shocks of different duration

Figure 5 portrayed the first period or impact of the FBA under different assumptions, while Figures 9, 10 and 11, illustrate the dynamic response of FBA w.r.t. tradable GDP in the SOE from the second quarter after the shock onwards. Notice that the rate of convergence to the steady state is rather similar, though the first impact differences in the level effect are considerable as to Figure 5 illustrates. In the interpretation of the FBA variable it is crucial to understand that the large magnitude of the FBA (deviation from its steady state, which is zero) owes to the fact it is reinforcing the effect a dynamic decrease of the tradable output. Tradable output decreases because the shock in the exports price makes the exporters to supply less to the (now) less profitable market and since the disconnection of the foreign and home market produced by the pricing rule assumed. Home tradable final goods prices are quite independent from exports prices since the monopolist is supplying differentiated products to home and foreign markets.

The shock in exports price that Argentina experienced in the first quarter of 1996 was understood as transitory but ex post took 3 years of persistent duration. Our model is able to replicate a path of FBA that differs depending on the duration of the shock.

Argentina did not vary the foreign currency denominated bonds issuing rate, which was clearly inconsistent with this set of foreign prices, no discernible adjustment in the rate of bond decumulation took place and that weaken considerable solvency standards by the end 1999 and 2000.

The analysis of the accumulated foreign bonds to shocks of different duration must be conducted considering together Figure 5 and Figures 9 to 11. We observe that the dynamics are evolving (in their slopes) under our 4 cases simulated quite the same. However, the differential level at which they develop are rather different ranging from the lowest which is lower friction in the capital markets and free trade (most perfect case) to the case of lower relative indebtedness when frictions are highest and the economy is relatively in closed.

Figure 9

Response of FBA to tradable GDP ratio to a *purely temporary* ($\alpha=0$) shock in exports price

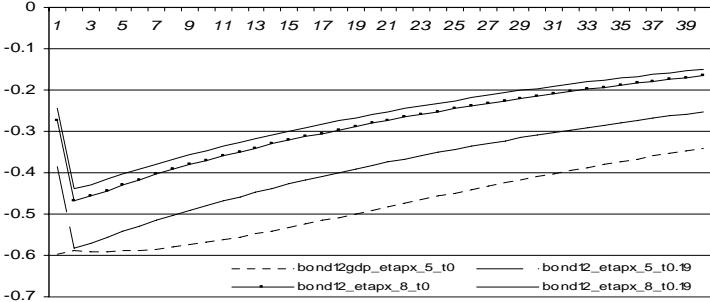


Figure 10

Response of FBA to tradable GDP ratio to a *permanent* ($\alpha=0.8$) shock in exports price

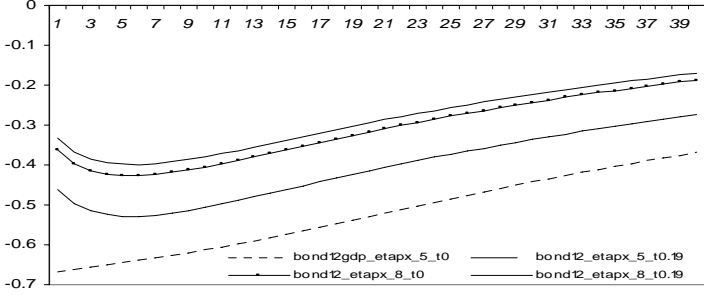
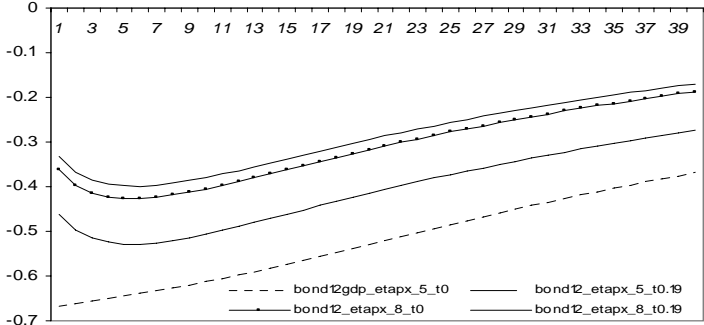


Figure 11

Response of FBA to a *permanent* ($\alpha=0.9517$) shock in exports price. Half-life 14 quarters



6. CONCLUSIONS

An important policy implication from our explanation of the Argentine crisis is that it is indeed advisable to be cautious in managing processes of trade liberalization. It is necessary to stress that export projections are somehow spurious given the well-known "peso problem" in data. In that respect, Keereman (1999), states that forecasting exports of small countries may be particularly difficult. He finds that, while the quality of predictions of the European Commission usually stands up quite well to tests on forecast accuracy, "the variables related to international trade are the most difficult to forecast... ". An incorrect assessment of international economic developments is considered to be an important source of prediction mistakes, and the smaller countries represent the worst record of forecasting performance, due to their sensitiveness to international economic developments.

We emphasize that such a projection error in exports make the country over-issue bonds beyond the true solvency restriction. In consequence, some form of capital regulation, e.g. a Tobin's tax as in Chile, may reduce the probability of default.

We distinguish between the first impact on the CA and the FBA once the shock in exports price takes place. The CA reacts more when the free trade is operating, and the response of the CA is minimized as long as the exports price shock is more permanent. Consequently, the bulk of the adjustment is in consumption in the very short run.

The findings in the evolution of the FBA when the exports price shock is occurring with different duration are that the FBA dynamics are evolving under our 4 simulated cases with quite similar slopes in the development of the dynamics. However, the differential level at which they develop are rather different ranging from the lowest which considers lower friction in the capital markets and free trade (the case most similar to perfect markets) to the case with relative less indebtedness as a result of a higher friction and closed economy.

Further directions for future research are: (i) the model can be easily extended to split the purely price effect and the wealth effect out of the total effect. This will provide a more accurate measure of the adjustment pattern in the SOE; (ii) adding intermediate goods and capital goods and investment may change the picture of the reaction of the CA since the terms of trade is an hybrid variable that captures all the relative prices effects (both tradable inputs and outputs); and (iii) institutional arrangements concerning the commitment of the CB can be introduced in the management of the monetary policy. It is desirable look for the optimal monetary rule instead of a simple rule as we used in order to enhance the individual welfare.

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APPENDIX

A.1 Demands System

Consumption of varieties indices for home tradables, non-tradables and imported are

$$C_{H,s}^j = \left[\varphi^{\theta_h} \int_0^{\bar{\omega}} c_{H,s}^j(h)^{\frac{\theta_h-1}{\theta_h}} dh \right]^{\frac{\theta_h}{(\theta_h-1)}}, \quad C_{F,s}^j = \left[(1-\varphi)^{\theta_f} \int_{\bar{\omega}}^1 c_{F,s}^j(f)^{\frac{\theta_f-1}{\theta_f}} df \right]^{\frac{\theta_f}{(\theta_f-1)}}, \quad \text{and}$$

$$C_{NT,s}^j = \left[\varphi^{\theta_{nt}} \int_0^{\bar{\omega}} c_{NT,s}^j(h)^{\frac{\theta_{nt}-1}{\theta_{nt}}} dh \right]^{\frac{\theta_{nt}}{(\theta_{nt}-1)}}, \quad \text{respectively, where } \theta_h > 1, \theta_f > 1 \text{ and } \theta_{nt} > 1 \text{ are elasticities of substitution.}$$

Define the (home) Consumer Price Index (CPI) as P_s , and each category of good

price as $P_{H,s}$, $P_{F,s}$ and $P_{NT,s}$.³¹

Given one bundle C_s^j , the solution of the period s (intra-temporal) minimization of the expenditure $P_s C_s^j$ subject to eq. (1) produce consumer j demands:

$$C_{T,s}^j = \gamma \left[P_{T,s} / P_s \right]^{-\eta_c} C_s^j \text{ and } C_{NT,s}^j = (1-\gamma) \left[P_{NT,s} / P_s \right]^{-\eta_c} C_s^j.$$

In a second step, taking $C_{T,s}^j$ as given, we minimize $P_{T,s} C_{T,s}^j$ subject to the budget constraint (2). Optimal demands of home tradables and imports are the result:

$$C_{H,s}^j = \varphi \left[P_{H,s} / P_{T,s} \right]^{-\eta_t} C_{T,s}^j, \text{ and } C_{F,s}^j = (1-\varphi) \left[\varepsilon_s P_{F,s}^* / P_{T,s} \right]^{-\eta_t} C_{T,s}^j, \text{ where } \varepsilon_s \text{ is the number of home currency needed to buy one unit of foreign.}$$

Given the demands of bundles $C_{H,s}^j$, $C_{NT,s}^j$, and $C_{F,s}^j$, typical varieties' demands are

$$c_{H,s}^j(h) = \left[p_{H,s}(h) / P_{H,s} \right]^{-\theta_h} C_{H,s}^j, \quad c_{F,s}^j(f) = \left[\varepsilon_s p_{F,s}^*(f) / P_{F,s} \right]^{-\theta_f} C_{F,s}^j, \quad \text{and} \\ c_{NT,s}^j(h) = \left[p_{NT,s}(h) / P_{NT,s} \right]^{-\theta_m} C_{NT,s}^j.$$

We assume that the home government only purchases NTs, with demand $g_{NT,s}(h) = \left[p_{NT,s}(h) / P_{NT,s} \right]^{-\theta_m} G_{NT,s}$.³²

Labour input varieties in each sector are aggregated as we did with

goods: $N_{H,s}^i = \left\{ \varphi^{\nu_H} \int_0^\varphi N_{H,s}^{j,i} \frac{\nu_H-1}{\nu_H} dj \right\}^{\frac{\nu_H}{\nu_H-1}}$ and $N_{NT,s}^i = \left\{ \varphi^{\nu_{NT}} \int_0^\varphi N_{NT,s}^{j,i} \frac{\nu_{NT}-1}{\nu_{NT}} dj \right\}^{\frac{\nu_{NT}}{\nu_{NT}-1}}$.³³ The market

clearing conditions of final goods determine the wage paid by the tradables sector.

³¹ For instance, the minimum price to buy $C_{H,s}^j = 1$ would be $P_{H,s} = \left[\varphi^{-1} \int_0^\varphi p_{H,s}(h)^{1-\theta_h} dh \right]^{\frac{1}{1-\theta_h}}$. With a similar interpretation and definition for $P_{NT,s}$ and $P_{F,s}$: To buy a bundle $C_{T,s}^j = 1$ and $C_s^j = 1$ prices are $P_{T,s} = \left[\varphi P_{H,s}^{1-\eta_t} + (1-\varphi) P_{F,s}^{1-\eta_t} \right]^{\frac{1}{1-\eta_t}}$ and $P_s = \left[\gamma P_{T,s}^{1-\eta_c} + (1-\gamma) P_{NT,s}^{1-\eta_c} \right]^{\frac{1}{1-\eta_c}}$.

³² The public expenditure in NTs adds no utility to the consumer.

³³ With ν_H and ν_{NT} both >1 . Let $w_{H,s}^j$ and $w_{NT,s}^j$ denote the nominal wage paid by H and NT sector to

worker $j \in [0, \varphi)$ in period s . Home wage indices are $W_{H,s} = \left[\varphi^{-1} \int_0^\varphi w_{H,s}^j 1^{-\nu_H} dj \right]^{\frac{1}{1-\nu_H}}$ and

$W_{NT,s} = \left[\varphi^{-1} \int_0^\varphi w_{NT,s}^j 1^{-\nu_{NT}} dj \right]^{\frac{1}{1-\nu_{NT}}}$ and demands are $N_{H,s}^{j,i} = \left[w_{H,s}^j / W_{H,s} \right]^{-\nu_H} N_{H,s}^i$ and

$N_{NT,s}^{j,i} = \left[w_{NT,s}^j / W_{NT,s} \right]^{-\nu_{NT}} N_{NT,s}^i$.